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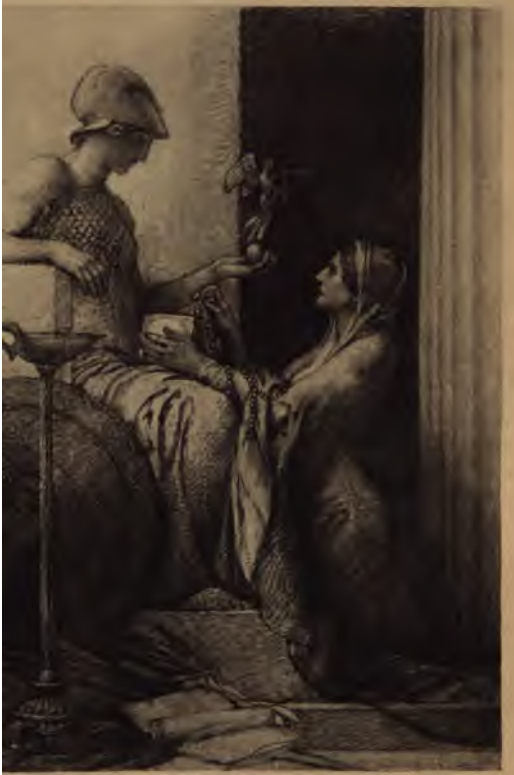

ABSTRACT

OF

GEONOMY,

THE ORIGIN OF

CONTINENTS AND MOUNTAINS.

"Let truth with error grapple, who ever knew
Her put to worse, in a free and open encounter?"
—*Milton.*

BY J. STANLEY GRIMES.

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ABSTRACT OF GEONOMY;

A NEW THEORY OF THE ORIGIN OF CONTINENTS AND MOUNTAINS.

By J. STANLEY GRIMES.

INTRODUCTION.

At a meeting of the American Association for the Advancement of Science, held at Salem, Massachusetts, I submitted a paper on the Laws of Mountain Formation, which was violently opposed by the Chairman of the Section, Prof. Louis Agassiz, for the reason, as he declared, that my ideas were "contrary to the experiences of Geologists for the past thirty years," and that I ignored "the first principles of Geology."

The extraordinary attempt to prevent the paper from being read through and fairly discussed, made by Prof. Agassiz as soon as he had heard enough to ascertain that it controverted his own long cherished opinions, his unsuccessful endeavors to induce the other Geologists to unite with him in opposition, and the one-sided statements, personalities and misrepresentations, evidently made by persons under his influence, in several journals, have naturally produced considerable curiosity to know more definitely the character of a scientific heresy that could produce such a commotion. I have accordingly received numerous communications requesting me to

furnish a printed abstract of the new theory. After a delay, during which I have carefully re studied the subject, I have concluded to comply with this request. publishing a clear and brief statement of what I conceive be the real origin and manner of upheaval of continents mountain chains, I shall enable the scientific portion o public to judge to what extent I am deserving of censu of approbation. If, upon a candid and fair comparisc my views with those taught by Prof. Agassiz and other appears that my ideas are entirely erroneous, I shall utte complaint when they are condemned. Error deserves friends, and truth, in a fair field, can safely bid defiance tc its enemies. Having devoted a great deal of time and la to the investigation, and carefully weighed all the essen facts and arguments that have been published upon the s ject, I feel confident that I am, in the main, correct. If I mistaken, I am exceedingly desirous to discover it, and sh not be in the least ashamed to acknowledge it.

Any one not well acquainted with the subject would na rally suppose, from the language of Prof. Agassiz, that t theory of mountain formation taught by him was found upon the principles and facts of Geology which have be developed during the past thirty years. But the truth that it is not founded upon Geology at all. It originated the imagination of Descartes and Leibnitz before Agassiz, even Werner, was born—before the essential facts or fir principles of Geology were understood by any one. Pro Agassiz leaves us in no doubt concerning his own "first prin ciples," and any one who will read the reports of his lecture in New York, published in the *Tribune*, and compare his idea with those of Leibnitz, will perceive that he has not only kept to the ancient faith, but that he out-Herods Leibnitz himself in extravagance.

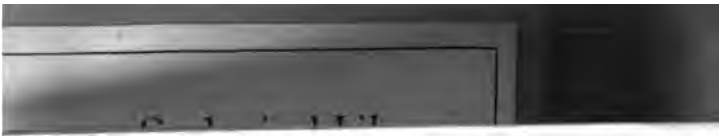
The well informed Geologist will perceive that I do not deny or controvert any of the established facts of Geology.

My dispute is not with the Geologists but with those Imaginationists, of whom Prof. Agassiz is the most prominent representative.

I hope to be able, at some future time, to publish a more detailed and illustrated account of my views upon these interesting subjects.

CHICAGO, ILLINOIS, August, 1871.

NOTE.—In his "Geological Sketches," Prof. Agassiz declares—and he certainly carries the idea into practice—that "*imagination, chastened by correct observation, is our best guide to the study of nature.*" I beg leave respectfully to suggest that logical reasoning, chastened by correct observation, is quite as reliable a guide as imagination in the study of anything. Few persons surpass Prof. Agassiz in collecting and arranging the details and minutiæ of certain departments of Natural History. His mind, like his museum, is stored with the crude and lifeless materials of science that have been accumulated during his long career. But when he attempts to discover the laws, without which the facts of science have no vitality, he seems to surrender himself entirely to the guidance of his imagination.



ABSTRACT OF GEONOMY:

A NEW THEORY OF THE ORIGIN OF CONTINENTS AND MOUNTAINS.

By J. STANLEY GRIMES.

The writer agrees with other Geologists that the ocean primitively covered the whole globe, but he denies that there is any proper evidence that the continents or mountains owe their elevation to the cooling and contraction of the interior matter of the globe, and the consequent collapsing of the external crust. He adopts the idea first suggested by Herschel and Babbage, and sanctioned by several eminent Geologists, that nearly all upheavals have resulted from the sedimentary deposits that have accumulated upon the ocean's floor. These deposits, from various causes, became heated and melted; over this melted mass a crust formed, which was capable of bending beneath the weight of an extraordinary load of sediment. The lava beneath the depressed places would necessarily be crowded away and forced under the crust into the

places less heavily loaded. In this way depressions and elevations—ocean basins and continents were produced.

To account for the peculiar forms and relative positions of the continents, the writer undertakes to prove that the ocean currents, which distributed the sediments, all have a tendency to flow in elliptical circuits, but that the curve formed by a current is necessarily such that there was not room enough for the primitive currents to form complete ellipses, except in the zone of each hemisphere between the equator and the 45th parallel. In this zone the curves are such as to form three ellipses and no more. The sediment was deposited on the ocean's floor in greater quantities within the limits of the ellipses than elsewhere, and by its weight it produced six oceanic basins, namely, the North and South Atlantic, Pacific and Indian basins. In the spaces between these three pairs of basins the crust was crowded upward to constitute the continents.

In this manner the causes of the peculiar forms, the number and the relative positions of the continents, which have been regarded as "perhaps, unconquerable problems," are perfectly explained. This may be called the primitive plan or theoretical map of the world, as it would have appeared if the oceanic depressions and continental elevations had all been equal and symetrical. In comparing this plan with the actual map of the world,

it will be found that the coincidences are quite as great as could be expected, when we consider the circumstances which would be likely to operate to produce variances. The southern or ant-arctic lands, in strict accordance with the theoretical map, should have been counterparts or repetitions of the three northern continents, but they are, in fact, nearly suppressed or imperfectly developed, while the northern continents are abnormally enlarged. Besides, the North Indian ocean basin has had a large portion of its floor raised and drained since the Tertiary age, so that its elliptical circulation is no longer possible. The lands thus raised serve to connect Europe and Eastern Asia together, and form one great continent. But after making all due allowance for these discrepancies, the evidence that the elliptical currents gave birth to the continents appears to be sufficient to satisfy any reasonable mind.

There are three pairs or series of continents, namely, North and South America, connected by an isthmus; 2. Europe and Africa, connected by an isthmus; 3. Eastern Asia and Australia, connected by an isthmus, which is partially covered by shallow water. These three series are somewhat similar to each other in form, so much so that A. K. Johnson remarks that they are three Americas; that is to say, Europe and Africa is a repetition of North and South America; and Eastern Asia with Australia is another repetition of the American

forms. It seems as if the natural forces that produced the American series repeated the process and produced the Europe-African series, and by repeating it again produced the Asia-Australian series. Turning our attention to the outlines and relative positions of the oceans, we see that there are, as Guyot has remarked, two and a half pairs—a north and south pair of Atlantic, and a north and south pair of Pacific Oceans, and also a South Indian, but not a North Indian Ocean. In looking, however, at a geological map, we learn that no longer ago than the Tertiary age, there was a North Indian Ocean, in every essential respect analogous to the North Atlantic; so that there were then three pairs of great oceans corresponding with the three series of continents. It is now evident that if the continents were elevated in consequence of the sinking of the ocean floor beneath the weight of the sediment that had been unequally distributed, the currents that distributed the sediment must have been governed by some law, hitherto unrecognized, that caused them to deposit the sediment in such a manner as to create six sinking basins, three each side of the Equator and none of them extending further from the Equator than the 60th parallel.

THEORY OF THE OCEAN CURRENTS.

As the explanation of the currents made by the writer underlies his theory of the origin of the

continent, and is in itself entirely novel, it should be more particularly stated.

1. It is an admitted fact that in each of the five great oceans there is a current continually flowing to and from the equatorial zone; and as the current that flows from the equator is invariably a warm one, and that which flows toward it is a cold one, it is inferred that the two currents result from the difference of temperature in the different latitudes.

2. It has long been known that when a current flows *from* the equator, the axial rotation of the globe has the effect to turn it more or less in an easterly direction; and on the contrary, a current *toward* the equator is, by rotation, turned more or less in a westerly direction; the consequence is that no currents are found in the open sea flowing due north or due south.

In the northern hemisphere this theory affords a perfect explanation of all currents that flow north-easterly or south-westerly; and in the southern hemisphere it explains all those currents that flow south-easterly or north-westerly; but it explains no other currents: none that flow due east or due west; and none that flow north-west in the northern, or south-west in the southern hemisphere. Furthermore, it gives no explanation of the fact that in each of the five great oceans, one vast current flows entirely around the ocean basin, in an elliptical circuit. Scientists have been forced to account for these exceptional currents by attribut-

ing them to the deflecting influences of the winds and the shores. But the truth is that some of these currents flow in situations where there are no shores, and where the wind blows in a contrary direction.

When the writer became satisfied that the ocean currents flowed in six elliptical circuits before there was any dry land, and while the continents were yet unborn—that in a word, the currents, by their operations, originated the ocean basins and the continents, he was forced to conclude that the currents, like the planets, move in elliptical paths by virtue of a natural and irresistible law. But there was one important difference: the causes of the elliptical motion of the planets were known, while those of the ocean currents were unknown. This problem the writer believes that he has now solved, and the following is his solution:

3. A current that flows northward *from* the Equator, is not only deflected by the earth's rotation so as to flow north-easterly, but the relative easterly motion is continually increasing the further north it flows, and the increase is so rapid that after flowing about 20 to 25 degrees north, it is forced to flow nearly due east. On the contrary, when a current flows south *toward* the Equator, it continually enters latitudes where the axial rotation is more and more rapid, so that the current lags behind, and flows relatively more and more

westerly, until, after flowing about 20 to 25 degrees south, it is forced to flow relatively due west. This fact of the continual increase and accumulation of relative force, as the current flows north or south, has been hitherto overlooked or unknown, and for that reason the currents have never been understood. Scientists have, therefore, been forced to conjecture that certain currents pursue the directions that they do in consequence of the influences of winds or shores, when the real cause was the increase of the relative easterly or westerly forces, as just described.

Let us illustrate our theory by applying it to the elliptical current that circulates in the North Atlantic.

Let *A* represent a point in the Gulf of Mexico at the 25th parallel, where the water has the motion proper to the globe in that latitude. From *A* the water flows north 20 degrees to *B* in the 45th parallel, and near the Grand Banks of Newfoundland. The relative easterly force continually increases until, when the current reaches the Banks, it is forced to flow due east across the Atlantic. It will readily be conceived that after flowing from the Gulf 20 degrees north to the Banks the current would flow due east, when we learn that the axial velocity of the globe is about two hundred miles per hour greater at the Gulf than at the Banks. If a man could suddenly be

transported the whole distance, he would, on his arrival at the Banks, find himself moving eastward across the Atlantic at the rate of two hundred miles per hour. Or if he could be transported instantly from the Banks to the Gulf he would, on his arrival there, find the face of the globe rushing past him eastward at the rate of two hundred miles per hour, though it would *seem* to him that he was himself moving westward at that rate.

4. While flowing due east across the Atlantic, so much of the water of the current as occupies the surface of the sea becomes cold, and *therefore* turns southerly; that is to say, it flows south-easterly until the easterly force (derived from the 25th parallel) is all expended, and the water once more has the same easterly velocity that the globe has in that latitude. This takes place (at C) near the 35th parallel.

5. The water being cold flows south from the 35th parallel; and now it continually enters parallels in which the axial motion of the globe is greater than that of the current, and therefore the current flows relatively more and more westward. The relative westerly force continually increases until (at D,) near the 10th parallel, the current begins to flow due west, and keeps this course nearly across the ocean.

6. While flowing westward that part of the current that occupies the surface becomes warm, and

therefore flows northward, that is, it flows north-west until it enters the Gulf of Mexico, and thus completes its elliptical circuit.

7. All currents tend to flow in elliptical circuits, but the curves which the currents make are so large that they cannot find room sufficient to make complete ellipses anywhere except in the two zones between the equator and the 45th parallels; the consequence is, that all currents, except the ellipses, are of a local and limited character. Cold local currents all flow westerly, and warm local currents all flow easterly; and, for obvious reasons, they often flow counter to the elliptical currents; whenever any two currents are found flowing counter to each other, one is in all cases a local and the other an elliptical current.

The discovery of the elliptical motion of the planets, and the causes of those motions, laid the foundation of the science of Astronomy; may we not be permitted to hope that the discovery of the elliptical motion of the ocean currents, and the causes of those motions, has now rendered a science of Geonomy possible?

NOTE.—According to the laws of the currents which are here explained, no local current in the northern hemisphere ever flows north-west nor south-east, nor in the southern hemisphere is a local current found flowing south-west nor north-east. When a current is known to flow in one of these directions it is part of an ellipse.

That part of the current that flows east across the Atlantic, and which does not become cooled, continues its due eastward course until it strikes the coast of Europe, and is deflected northward along the

ORIGIN OF MOUNTAINS.

Mountains are the offspring of shores, and were begotten upon them by the action of the waves. Before the continents emerged from the sea and formed shores, none of the mountain ranges now in existence had been created. The waves acted with a force greater than that of Niagara against the primitive shores, tearing away the materials and forming coarse sediment. This sediment was conveyed but a short distance before it was re-deposited in lines parallel with the shores. Its weight produced depressions, and consequent parallel elevations or mountain ranges near the shores.

A distinction must be made between the borders or outlines of continents and the shores of the dry lands that had emerged from the sea at a particular time. The outlines of the continents were laid out and determined by the operations of the six great elliptical currents before any dry land emerged above the sea. Mountains coincide in trend with the nearest shores of the cotemporaneous dry land, whether these shores were identical with the bor-

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coast of Norway. It enters the Arctic Sea and flows eastward around it and re-enters the Atlantic, and flows south along the east coast of the United States.

As the elliptical currents do not give circulation to the waters north of the 45th parallel in the northern hemisphere, or south of that latitude in the southern, it follows that all the currents found between the pole and the 45th parallels are of a local character.

ders of continents or not. This being the case, the history of the creation of mountains is associated with the history of the emergence and growth of the dry lands of each continent. The trends of the shores of the emerged lands, and the order of time and place in which these shores were created, coincided with those of the mountain ranges. It is true that every shore did not give birth to a mountain, though it doubtless had a tendency to do so, but every mountain range that was created resulted from the operation of waves upon a shore in the near vicinity.

There appears to have been three different modes in which mountains were created parallel with shores:

1. In the manner already described, by the deposit of sediment and the depression of the bed of a shallow sea that covered a part of a rising continent.

2. By the corrugation of strata, which were first deposited horizontally, then sunk and heated, and expanded horizontally, so as to require more room, and then raised again and forced to occupy the same area that they did before their expansion. In undergoing this operation, the strata necessarily became corrugated, or folded in parallel folds. A large portion of the Appalachians seem to be corrugated in this manner. The folds are most numerous where the deposits were thickest, and

consequently the depressions the greatest, and the heating and metamorphoses the most extreme. The steeper side of each fold is that which looks toward the neighboring plain where the deposits were thinnest, and the heating and lateral pressure the least. In the Appalachian region, this is generally the western side.

3. Some mountains are composed of strata that lie horizontally, and thus indicate that they were not created in either of the modes already described. They are of the nature of bluffs, though in some instances they are more than three thousand feet high. The Catskill and the White Mountains are believed to belong to this class. The neighboring region has been denuded and the strata swept away by the waves or floods, leaving the remaining area in an elevated and isolated position.

But it must be particularly observed that in all three of these processes by which mountains were created, the waves were the active and efficient agents upon which the results depended.

Continents were elevated in consequence of the depressions of the great and general ocean's floor, but mountains were uplifted in consequence of local and limited depressions made in the faces of the rising continents, while they were covered by comparatively shallow seas. Continents have continued to rise gradually, and almost equally, in all quarters of the globe, from the earliest geologic

ages; but mountains have risen at different times and places, independently of each other and of the general rise of the continents.

The reason why the modern mountains are higher than the more ancient ones, is because the earlier mountains were raised upon islands that were oscillating and unstable, and were repeatedly depressed beneath the surface of the sea, and denuded by the waves. It can be proved that had it not been for this denuding process, some of the Appalachians, of Pennsylvania, would be higher than any mountains now existing on this continent. Modern mountains were not created until the continents had so far escaped from the sea as to become permanent, so that when a shore was once raised to a great height it was not afterward liable to be again depressed.

There were two forces that acted upon the continents:

1. The gradual and continuous elevating force. Before the continents rose high enough to come within the reach of the waves, this was the only force that operated.

2. When the land emerged and shores were formed, a new force—that of the waves, was brought to bear, producing local and limited depressions and elevations. When a continent or large area had risen entirely above the sea, the gener-

al elevating force alone operated, and the depressing force ceased entirely.

On the continent of North America, the first dry land emerged, and the first shore was formed in Canada, and there the first mountain range, the Laurentians, were created, with their trends coinciding with those of the shore then nearest to them. This was in the Eozoic age. The water then retreated eastward as the land continued to emerge, and a new shore was formed in New England during the Silurian period. Then it was that the second range, the Green mountains, arose parallel with the new shore. Again the water retreated eastward and new lands emerged in the Devonian period, and then the Catskill and the White mountains were created. South of New York no extensive dry lands and no shores yet existed, and of course there were no mountains. In the carboniferous period the Appalachian area emerged from the sea—a long, low island, upon which the coal producing plants grew for unknown centuries. This island sank and rose again and again, and finally became permanent dry land with its mountain ranges parallel with the Atlantic shores. The Ozark Mountains were created at about the same time parallel with the shores of the Gulf. At this time none of the mountains west of the Mississippi existed. The area now occupied by them was covered by the Pacific.

But as soon as the dry land emerged, the Rocky and Nevada ranges began to rise. When this immense chain was completed, the coast range of mountains was yet unborn. The area was beneath the sea. The most western mountain system was the last that was created upon this continent, and it is parallel with the western shore. The history of the other continents, as far as it is known, confirms the lesson thus taught by that of North America.

Most of the mountains of Northern and Eastern Asia, and of Northern and Western Europe were created before the Tertiary age, leaving a vast Mediterranean Sea, which was doubtless comparatively shallow, and which covered the rising continent. In the midst of this interior sea, the highest plateaus and mountains of the world were raised, in comparatively modern times. It can easily be proved that neither the Alps nor the Himalaya were raised by the sinking of the bed of the great oceans, for the area now occupied by these mountains was then nearly surrounded by dry land which was not disturbed by their elevation.

The continents did not generally rise and emerge at their borders first, but dry lands emerged at a greater or less distance from the border of the continent and formed a shore. On that shore a mountain arose, and afterwards the dry land

extended itself, and perhaps another shore and another mountain ridge was formed, and then a third, and finally the border of the continent emerged after many oscillations.

The Laurentian Hills of Canada are at considerable distance from the border of the continent. Even the eastern slope of the Appalachians has a submarine extension of forty to eighty miles, or more, eastward, before the precipitous edge of the continent is reached. The Andes seem, on the map, to be raised directly on the western edge of South America, but it has been found that shallow water continues forty or fifty miles from the shore.

If we read the most modern Geological treatises, we may learn that, during the time that continents were rising, those areas that were covered by shallow water were continually oscillating. The same was true of the narrow, swampy islands in the midst of those submarine areas. The submerged surfaces of the continents were then in a position to receive a large portion of the sediment produced by the action of the waves and deposited in neighboring localities. These local deposits would produce local and repeated depressions, though the general continental elevation was slowly proceeding. When the continent had risen above the sea, the local oscillations, of course, ceased, though the general elevation continued.

We know of no instance of a mountain range

being created in the interior of a continent after the interior had been raised entirely above the ocean; nor do we know that any mountain range now existing on any continent was created in the deep sea. On the contrary, we have, in many instances, the most positive proofs that their elevation into mountain ranges commenced while their strata lay horizontally in shallow waters.

An interesting fact which bears directly upon this subject with considerable force, is that the greatest number of mountains were created in those Geological periods in which the largest areas emerged from the sea. During the Tertiary age more land emerged and more mountains were created than in all the former periods together, though it was confessedly the briefest of the ages. It is evident that when the requisite conditions existed, but a short time was required to give birth to a mountain. The vertical space occupied by the waves at any one time is not more than one or two hundred feet; yet it was during the transition of certain areas through this brief space that the principal part of the work of mountain making was done.

I believe that it will be found that in every instance where a large area arose and emerged with nearly equal rapidity on all its sides, as Australia and Northern Africa did, such area has most of its mountains near its borders, for the reason

that it never had any permanent shores, in any part of its interior, large enough to accumulate the deposits required to produce depressions and elevations. But when an area as it rose and emerged was broken up into detached islands and peninsulas, so as to create a great complication of permanent shores, such an area now contains a corresponding complication of mountains, the trends of which were as various as were those of their parent shores. The middle and southern parts of Europe are illustrations of this fact.